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09/676,727	09/29/2000	Francis X. Canning	CANNING.001A	2872

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EXAMINER	
DAY, HERNG DER	

ART UNIT	PAPER NUMBER
2128	

DATE MAILED: 08/24/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/676,727	CANNING, FRANCIS X.	
	Examiner	Art Unit	
	Herng-der Day	2128	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 May 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21 and 34-54* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-21 and 34-54* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This communication is in response to Applicant's Amendments and Response ("Amendment") to Office Action dated December 19, 2005, mailed May 19, 2006.

1-1. Claims 2, 10, 47, and 49 have been amended. Claims 23-33 have been canceled. Claims 52-54 have been added. Claims 1-21 and 34-54 are pending.

1-2. Claims 1-21 and 34-54 have been examined and rejected.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 38 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claims contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor, at the time the application was filed, had possession of the claimed invention.

3-1. Claim 38 recites the limitation, "wherein said matrix of received disturbances is substantially similar to a transpose of said matrix of received disturbances" in lines 3-4 of the claim, which does not appear to have support in the original disclosure. Applicant is requested to provide supporting evidence in the specification.

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 39 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

5-1. The term "substantially similar" in claim 39 is a relative term which renders the claim indefinite. The term "substantially similar" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. For example, composite sources are yielded from transmitted disturbances and composite testers are yielded from received disturbances, it is unclear "substantially similar" is referred to their function (i.e., transmitting vs. receiving), the procedure to yield them (reducing the matrix rank), or something else.

Claim Rejections - 35 USC § 101

6. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

7. Claims 1-21 and 34-54 are rejected under 35 U.S.C. 101 because the inventions as disclosed in claims are directed to non-statutory subject matter.

7-1. Claims 1-21 and 34-54 appear to be directed to the manipulation of abstract ideas of data compression, calculating composite sources and testers, and transforming equations without resulting in a practical application producing a concrete, useful, and tangible result. At least, no tangible result can be identified. Hence, the claims are directed to non-statutory subject matter. See In *re Warmerdam,* 33 F.3d 1354, 1360 (Fed. Cir 1994).

7-2. The Examiner acknowledges that even though the claims are presently considered non-statutory they are additionally rejected below over the prior art. The Examiner assumes the Applicant will amend the claims to overcome the 101 rejections and thus make the claims statutory.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

9. Claims 1-21, 34-37, and 40-54 are rejected under 35 U.S.C. 102(b) as being anticipated by Canning et al., Rockwell Inst. Sci. Center, "Fast Direct Solution of Standard Moment-Method Matrices", IEEE Antennas and Propagation Magazine, June 1998, pages 15-26, hereafter referred to as Rockwell.

9-1. Regarding claim 1, Rockwell discloses a method of data compression, comprising:

partitioning a first set of basis functions into groups, each group corresponding to a region, each basis function corresponding to one unknown in a system of linear equations, each of said basis functions corresponding to an original source (basis functions, page 16, left column, paragraph 1);

selecting a plurality of spherical angles (angle, page 15, right column, the last paragraph);

using a computer system, calculating a far-field disturbance produced by each of said basis functions in a first group for each of said spherical angles to produce a matrix of transmitted disturbances (matrix A, page 15, right column, the last paragraph);

reducing a rank of said matrix of transmitted disturbances to yield a second set of basis functions, said second set of basis functions corresponding to composite sources, each of said composite sources comprising a linear combination of a number N of said original basis functions (the SVD of A, page 16, left column, the last paragraph);

partitioning a first set of weighting functions into groups, each group corresponding to one of said regions, each weighting function corresponding to a condition, each of said weighting functions corresponding to an original tester (testing functions, page 16, left column, paragraph 1);

using a computer system, calculating a far-field disturbance received by each of said testers in a first group for each of said spherical angles to produce a matrix of received disturbances (matrix A, page 15, right column, the last paragraph);

reducing a rank of said matrix of received disturbances to yield a second set of weighting functions, said second set of weighting functions corresponding to composite testers, each of said composite testers comprising a linear combination of a number M of said original testers (the SVD of A, page 16, left column, the last paragraph), wherein at least one of either M or N is greater than one (SVD is used to calculate the low-rank approximation to block A and from equation (3) at page 16, left column, each row or column of matrix D is a linear combination of corresponding rows or columns of matrix A); and

transforming said system of linear equations to use said composite sources and said composite testers (a fast sparse solution, page 16, left column, the last paragraph).

9-2. Regarding claim 2, Rockwell discloses a method of data compression, comprising:

partitioning a first set of basis functions into groups, each group corresponding to a region, each basis function corresponding to an unknown in a system of equations, each of said basis functions corresponding to an original source (basis functions, page 16, left column, paragraph 1);

selecting a first plurality of angular directions (angle, page 15, right column, the last paragraph);

using a computer system, calculating a disturbance produced by each of said basis functions in a first group for each of said angular directions to produce a matrix of disturbances (matrix A, page 15, right column, the last paragraph);

using said matrix of disturbances to compute a second set of basis functions, said second set of basis functions corresponding to composite sources, wherein at least one of said composite sources is configured to produce a relatively weak disturbance from a portion of space around said at least one composite source (the SVD of A, page 16, left column, the last paragraph);

partitioning a first set of weighting functions into groups, each group corresponding one of said regions, each weighting function corresponding to a condition, each of said weighting functions corresponding to an original tester (testing functions, page 16, left column, paragraph 1);

using a computer system, calculating a disturbance received by each of said testers in a second plurality of angular directions to produce a matrix of received disturbances (matrix A, page 15, right column, the last paragraph);

using said matrix of received disturbances to compute a second set of weighting functions, said second set of weighting functions corresponding to composite testers, wherein at least one of said composite testers is configured to weakly receive disturbances from a portion of space relative to said at least one composite tester (the SVD of A, page 16, left column, the last paragraph); and

transforming at least a portion of said system of equations to use one or more of said composite sources and one or more of said composite testers (a fast sparse solution, page 16, left column, the last paragraph).

9-3. Regarding claim 3, Rockwell further discloses said matrix of disturbances is a moment method matrix (MoM matrix, page 16, left column, paragraph 3).

9-4. Regarding claim 4, Rockwell further discloses said step of using said matrix of disturbances to compute a second set of basis functions comprises reducing a rank of said matrix of disturbances (the SVD of A, page 16, left column, the last paragraph).

9-5. Regarding claim 5, Rockwell further discloses said step of using said matrix of received disturbances to compute a second set of weighting functions comprises reducing a rank of said matrix of received disturbances (the SVD of A, page 16, left column, the last paragraph).

9-6. Regarding claim 6, Rockwell further discloses said disturbance is at least one of an electromagnetic field, a heat flux, an electric field, a magnetic field, a vector potential, a

pressure, a sound wave, a particle flux, a weak nuclear force, a strong nuclear force, and a gravity force (electromagnetic interference, page 15, left column, the last paragraph).

9-7. Regarding claim 7, Rockwell further discloses said first plurality of directions is substantially the same as said second plurality of directions (angle, page 15, right column, the last paragraph).

9-8. Regarding claim 8, Rockwell further discloses said regions of space around said at least one composite source are far-field regions (these regions are not physically close to each other at any point, page 15, right column, the last second paragraph).

9-9. Regarding claim 9, Rockwell further discloses said at least a portion of a region around said at least one composite tester is a far-field region (these regions are not physically close to each other at any point, page 15, right column, the last second paragraph).

9-10. Regarding claim 10, Rockwell discloses a method of data compression, comprising:

calculating one composite source as a linear combination of more than one basis function, wherein at least one of said composite sources is configured to produce a relatively weak disturbance in a portion of space related to said at least one composite source (basis functions, page 16, left column, paragraph 1; SVD is used to calculate the low-rank approximation to block A and from equation (3) at page 16, left column, each row or column of matrix D is a linear combination of corresponding rows or columns of matrix A);

using a computer system, calculating one composite tester as a linear combination of more than one weighting function, wherein at least one of said composite testers is configured to be relatively weakly affected by disturbances propagating from a portion of space around said at least one composite tester (testing functions, page 16, left column, paragraph 1; SVD is used to

calculate the low-rank approximation to block A and from equation (3) at page 16, left column, each row or column of matrix D is a linear combination of corresponding rows or columns of matrix A); and

transforming at least a portion of a first system of equations based on said basis functions and said weighting functions into a second system of equations based on said composite sources and said composite testers (a fast sparse solution, page 16, left column, the last paragraph).

9-11. Regarding claim 11, Rockwell further discloses said disturbance is at least one of, an electromagnetic field, a heat flux, an electric field, a magnetic field, vector potential, a pressure, a sound wave, a particle flux, a weak nuclear force, strong nuclear force, and a gravity force (electromagnetic interference, page 15, left column, the last paragraph).

9-12. Regarding claims 12-16, Rockwell further discloses a technique applies not only to antenna and propagation problem, but also to all electromagnetic problems. It can be applied to matrices coming from nearly all integral-equation formulations and other linear wave phenomena (page 15, left column, the last paragraph through right column, paragraph 1).

9-13. Regarding claim 17, Rockwell further discloses each of said composite sources corresponds to a region (region, page 15, right column, the last second paragraph).

9-14. Regarding claim 18, Rockwell further discloses said second system of equations is described by a sparse block diagonal matrix (sparse representation, page 16, left column, paragraph 4).

9-15. Regarding claim 19, Rockwell further discloses comprising the step of reordering said sparse block diagonal matrix to shift relatively larger entries in said matrix towards a desired

corner of said matrix (to arrange the singular values in decreasing order, page 17, left column, paragraph 1).

9-16. Regarding claim 20, Rockwell further discloses comprising the step of solving said second system of equations (a fast sparse solution, page 16, left column, the last paragraph).

9-17. Regarding claim 21, Rockwell further discloses comprising the step of solving said second system of equations to produce a first solution vector, said first solution vector expressed in terms of said composite testers (vector, page 18, left column, paragraph 1).

9-18. Regarding claim 22, Rockwell further discloses comprising the step of transforming said first solution vector into a second solution vector, said second solution vector expressed in terms of said weighting functions (orthogonalized version, page 18, left column, paragraph 2).

9-19. Regarding claim 34, Rockwell further discloses said transforming said system of linear equations produces a substantially sparse system of linear equations.

9-20. Regarding claim 35, Rockwell further discloses N is greater than one and M is greater than one (SVD is used to calculate the low-rank approximation to block A and from equation (3) at page 16, left column, each row or column of matrix D is a linear combination of corresponding rows or columns of matrix A).

9-21. Regarding claim 36, Rockwell further discloses said transforming said system of linear equations produces a substantially sparse system of linear equations (a sparse representation of Z, page 16, left column, paragraph 4).

9-22. Regarding claim 37, Rockwell further discloses said matrix of transmitted disturbances is substantially different from said matrix of received disturbances (many fewer than m degree of

freedom are needed to described this interaction. Of course, to a different observation region, different degree of freedom will be necessary, page 15, right column, the last paragraph).

9-23. Regarding claim 40, Rockwell further discloses said matrix of received disturbances comprises a moment-method matrix (MoM matrix, page 16, left column, paragraph 3).

9-24. Regarding claim 41, Rockwell further discloses said matrix of transmitted disturbances comprises a moment-method matrix (MoM matrix, page 16, left column, paragraph 3).

9-25. Regarding claim 42, Rockwell further discloses said matrix of received disturbances comprises a moment-method matrix (MoM matrix, page 16, left column, paragraph 3).

9-26. Regarding claim 43, Rockwell further discloses said transforming at least a portion of said system of equations to use one or more of said composite sources and one or more of said composite testers comprises transforming substantially all of said system of equations to use one or more of said composite sources and one or more of said composite testers (a fast sparse solution, page 16, left column, the last paragraph).

9-27. Regarding claim 44, Rockwell further discloses said transforming substantially all of said system of equations produces substantial sparseness (a sparse representation of Z, page 16, left column, paragraph 4).

9-28. Regarding claim 45, Rockwell further discloses said relatively weak disturbance from a portion of space around said at least one composite source comprises a relatively weak disturbance from a far-field portion of space (the radiated field decays quickly for angles passing through successive sidelobes, page 18, right column, paragraph 1).

9-29. Regarding claim 46, Rockwell further discloses said relatively weak disturbance from a portion of space around said at least one composite source comprises a portion of space at

distances relatively shorter than a distance to other physical regions (the radiated field decays quickly for angles passing through successive sidelobes, page 18, right column, paragraph 1).

9-30. Regarding claim 47, Rockwell further discloses said portion of space at distances relatively shorter than a distance to other physical regions comprises a relatively non-intertwining portion of space (many fewer than m degree of freedom are needed to described this interaction. Of course, to a different observation region, different degree of freedom will be necessary, page 15, right column, the last paragraph).

9-31. Regarding claim 48, Rockwell further discloses said relatively weak disturbance from a portion of space around said at least one composite source comprises a portion of space comprising substantially all angular directions in said first plurality of angular directions (m sources are used to describe radiation in all directions and for all distances, page 15, right column, the last paragraph).

9-32. Regarding claim 49, Rockwell further discloses said portion of space comprising substantially all angular directions in said first plurality of angular directions comprises a relatively non-intertwining portion of space (many fewer than m degree of freedom are needed to described this interaction. Of course, to a different observation region, different degree of freedom will be necessary, page 15, right column, the last paragraph).

9-33. Regarding claim 50, Rockwell further discloses said transforming at least a portion of a first system of equations comprises transforming substantially all of a first system of equations based on said basis functions and said weighting functions into a second system of equations based on said composite sources and said composite testers (the SVD of A, page 16, left column, the last paragraph).

9-34. Regarding claim 51, Rockwell further discloses said second system of equations is substantially sparse (if p<<n, this is a sparse representation of A, page 17, left column, paragraph 3).

9-35. Regarding claim 52, Rockwell further discloses wherein said at least a portion of a first system of equations comprises an interaction between at least one of said basis functions is relatively close to and at least one of said weighting functions (the interaction of these two regions will be described by a retangular piece of Z, page 15, right column, paragraph 4).

9-36. Regarding claim 53, Rockwell further discloses wherein either said one or more composite sources is calculated using a matrix of transmitted disturbances or said one or more composite testers is calculated using a matrix of received disturbances (the SVD of A, page 16, left column, the last paragraph).

9-37. Regarding claim 54, Rockwell further discloses wherein either said one or more composite sources is calculated using a matrix of transmitted disturbances or said one or more composite testers is calculated using a matrix of received disturbances (the SVD of A, page 16, left column, the last paragraph).

Applicant's Arguments

10. Applicant argues the following:

10-1. Response to Rejection of Claims 47 and 49 Under 35 U.S.C. 112, First paragraph

(1) "Applicant has amended Claims 47 and 49 to recite a non-intertwining portion of space, as described in the specification." (page 11, paragraph 4, Amendment).

10-2. Response to Rejection of Claims 38 and 39 Under 35 U.S.C. 112, Second paragraph

(2) "The Examiner argues that the term "substantially similar" renders Claims 38 and 39 indefinite. Applicant respectfully disagrees. The Court of Appeals for the Federal Circuit has repeatedly found claims with the phrase "substantially similar" to be definite." (page 11, paragraph 6, Amendment).

10-3. Response to Rejection of Claims 1-37 and 39-51 Under 35 U.S.C. 102(b)

(3) "Rockwell does not teach or suggest that a second set of basis functions and a second set of weighting functions are be obtained by separate rank reductions." (page 12, paragraph 7, Amendment).

(4) "For Claim 1 when M is one, the teachings of Rockwell would produce a matrix with a dimension of 1 by p as a product of itself and a vector of length one, which is trivial." (page 12, paragraph 8, Amendment).

(5) "For Claim 1 when N is one, the teachings of Rockwell would produce a matrix with a dimension of p by 1 as a product of itself and a vector of length one, which again is trivial." (page 13, paragraph 2, Amendment).

(6) "In Rockwell, the new sources and testers are computed together, and must be used together. The new sources and testers of Rockwell are configured to interact weakly with each other. Rockwell does not teach that its new sources transmit weakly or that its new testers receive weakly in a portion of space." (page 14, paragraph 1, Amendment).

(7) Rockwell does not teach or suggest claims 1-22 and 34-51 (pages 13-18, Amendment).

10-4. Response to Rejection of Claims 10-11 Under 35 U.S.C. 102(b)

(8) "Using these matrices which are factors differs from producing a transformation as recited in Claim 10." (page 18, paragraph 8, Amendment).

Response to Arguments

11. Applicant's arguments have been fully considered.

11-1. Applicant's argument (1) is persuasive. The rejections of claims 47 and 49 under 35 U.S.C. 112, first paragraph, in Office Action dated December 19, 2005, have been withdrawn.

11-2. Applicant's argument (2) is not persuasive. Claims 38 is currently rejected under 35 U.S.C. 112, first paragraph, as detailed in section **3-1** above. Claims 39 is currently rejected under 35 U.S.C. 112, second paragraph, as detailed in section **5-1** above.

11-3. Applicant's arguments (4)-(6) are not persuasive. Rockwell discloses, in section 2, Z is the MoM matrix and A is a sub-matrix of Z representing the interaction of two regions, which are not physically close to each other. The SVD of A is considered for calculating a low-rank approximation to each block A. When M is one or N is one, the SVD of A still meet the claimed limitation of reducing matrix rank and yield composite sources or testers by selecting the largest elements in the matrix. Elements with smaller value transmitting or receiving weakly.

11-4. Applicant's argument (7) is not persuasive. Claims 1-21, 34-37, and 40-54 are rejected under 35 U.S.C. 102(b) as detailed in sections **9** to **9-37** above.

11-5. Applicant's argument (8) is persuasive. The rejections of claims 10-11 under 35 U.S.C. 102(b) in Office Action dated December 19, 2005, have been withdrawn.

Conclusion

12. Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Herng-der Day whose telephone number is (571) 272-3777. The Examiner can normally be reached on 9:00 - 17:30.

Any inquiry of a general nature or relating to the status of this application should be directed to the TC 2100 Group receptionist: (571) 272-2100.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, Kamini S. Shah can be reached on (571) 272-2279. The fax phone numbers for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Herng-der Day
August 21, 2006 H.D.

FRED FERRIS
PRIMARY EXAMINER
TC2100